

The influence of canopy structural traits on the understorey air temperature of tropical forests in Borneo

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Background

- Selective logging is responsible for 51% of forest disturbances in Asia and Latin America (Hosonuma et al., 2012).
- Accounting for around 12% of total CO₂ emissions from forest disturbances in tropical countries (Pearson et al., 2017).
- This directly impacts the forest microclimate and temperature under the canopy, which greatly influences forest functioning.
- Ecosystem dynamics are more closely linked to the microclimate than the macroclimate (De Frenne et al., 2012).
- Increased temperature variability inside forests can also raise the risk of species migration (Zellweger et al., 2020).

Research question

- What trait derived from Terrestrial Laser Scanning (TLS) data is most closely related to microclimate temperature in tropical forests affected by selective logging?
- Does the amount of material allocated over the vertical profile in the canopy have different effects on microclimate temperature?

Where

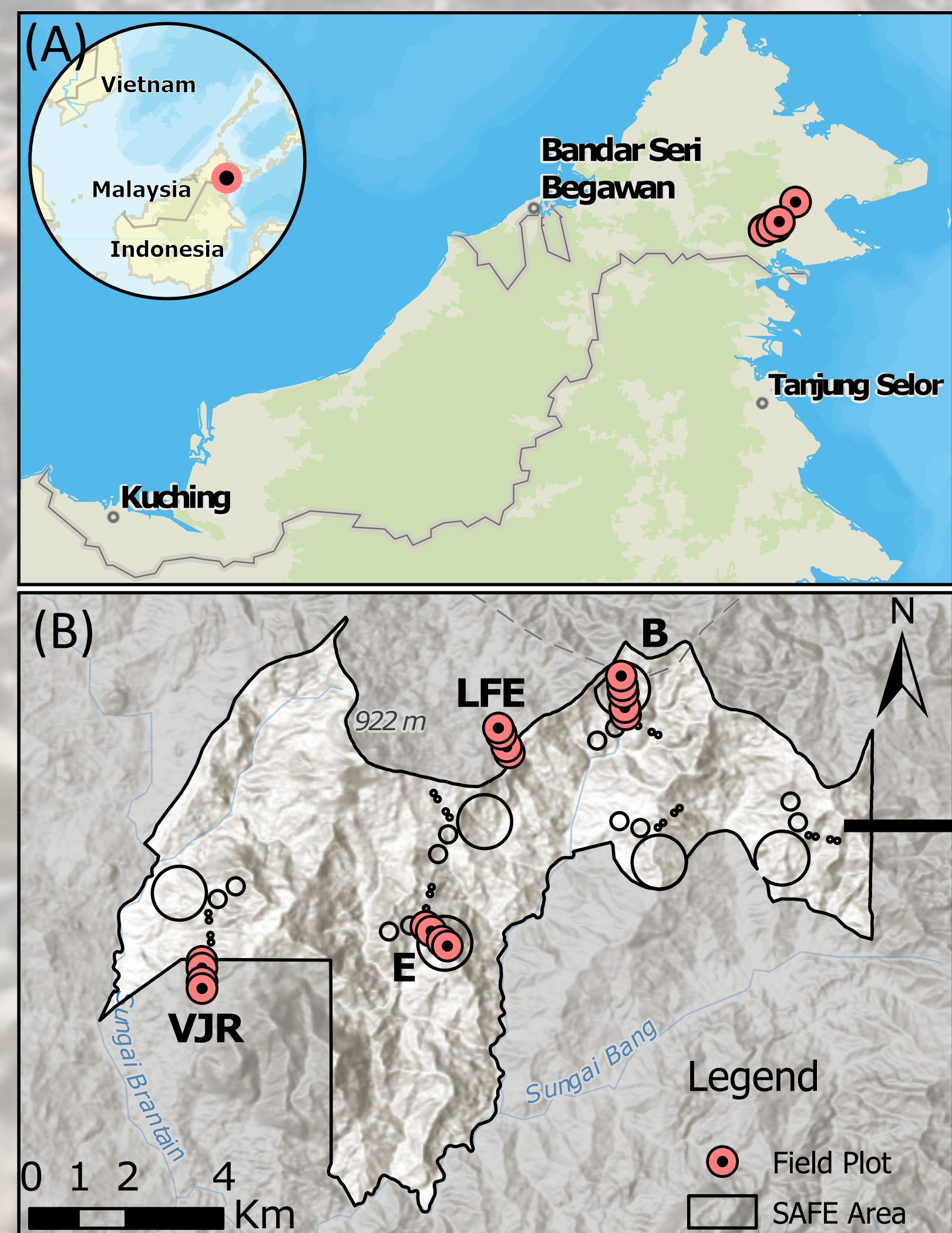
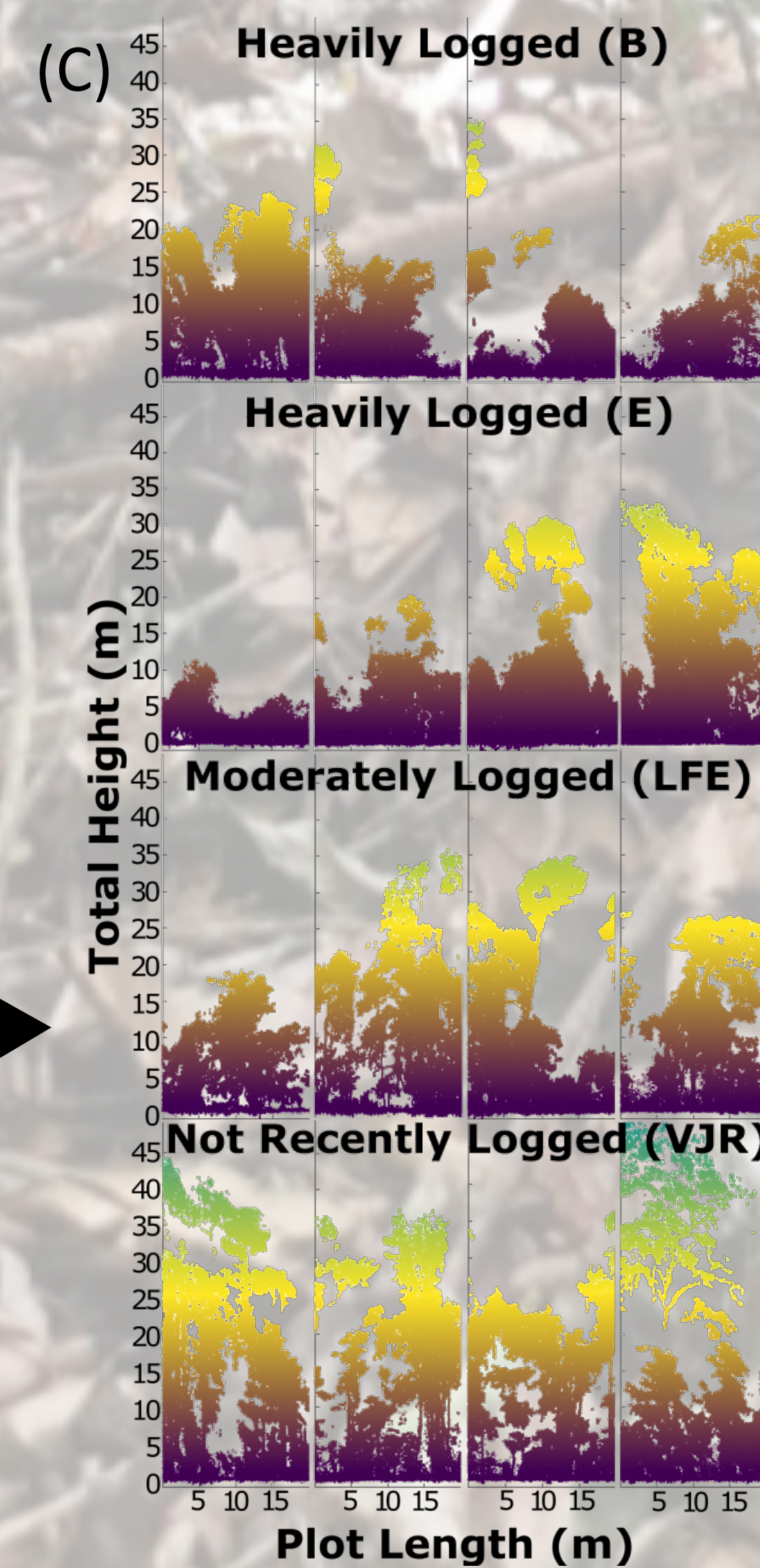


Figure 1: The study area location in relation to Malaysia Borneo Island (A). The location of the field plots, TLS and microclimate data (B). The vertical slice (20 m x 5 m) of each plot from the TLS cloud point.



Data & Methods

- Microclimate temperatures data were collected every 15 minutes throughout the year of 2019.

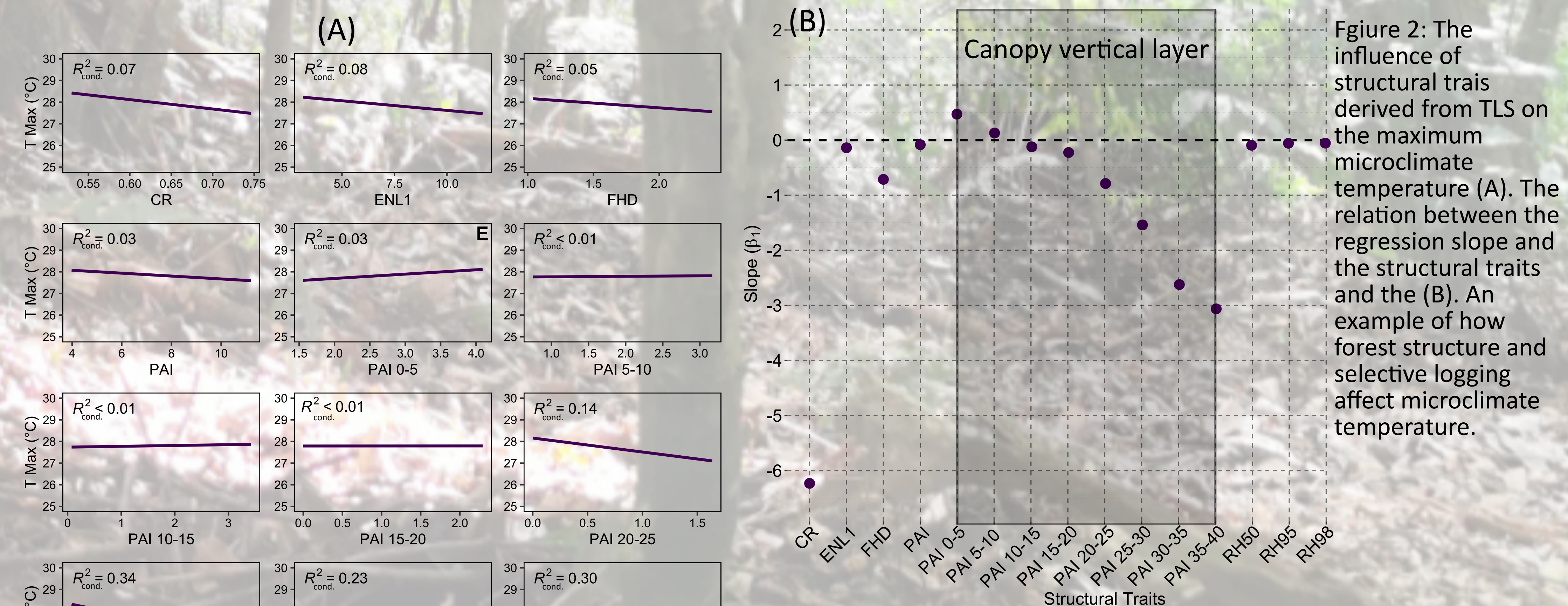
- Over 280 TLS measurements were collected in November 2019.

- A voxel approach was used to estimate vertical structural traits from TLS data.

- Canopy Ratio (CR), Effective Number of Layers (ENL1), Foliage Height Diversity (FHD), Plant Area Index (PAI), PAI in 5 m layers, Relative Height at 50, 95 and 98 percentile.

- Mixed-effects regression was used to evaluate the relationship between structural traits and microclimate temperature.

Microclimate temperature vs TLS structural traits



- PAI 25-30 showed the strongest relation with the microclimate temperature.

- The lower layers of the canopy have a positive relation with the microclimate temperature

Conclusion

- Not only the forest stand, but also the upper canopy layers have a greater influence on cooling the microclimate temperature.
- Traits in the middle canopy showed a stronger relationship in explaining the variability of microclimate temperature.

Acknowledgment



References

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